ACHIEVING ALIGNMENT: AN ANALYSIS OF ENTERPRISE ARCHITECTURE BEST PRACTICES WITHIN THE UNITED STATES AIR FORCE

THESIS

Michael A. Fetters, MSgt, USAF

AFIT/GIR/ENV/09-M01

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GIR/ENV/09-M01

ACHIEVING ALIGNMENT: AN ANALYSIS OF ENTERPRISE ARCHITECTURE BEST PRACTICES WITHIN THE UNITED STATES AIR FORCE

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Information Resource Management

Michael A. Fetters, BS

Master Sergeant, USAF

March 2009

AFIT/GIR/ENV/09-M01

ACHIEVING ALIGNMENT: AN ANALYSIS OF ENTERPRISE ARCHITECTURE BEST PRACTICES WITHIN THE UNITED STATES AIR FORCE

Michael A. Fetters, BS
Master Sergeant, USAF

Approved:

//SIGNED//	17 Mar 09
John M. Colombi, PhD (Chairman)	Date
//SIGNED//	17 Mar 09
Dennis D. Strouble, PhD, JD (Member)	Date
//SIGNED//	17 Mar 09
David S. Long, Lt Col, USAF (Member)	Date

Abstract

This research uncovers areas of best practices that support achieving alignment between an organization's Information Technology (IT) and its business processes. One principal finding of this effort revealed that the means used to achieve alignment exists within the effective application of Enterprise Architecture (EA), a common practice found throughout the Federal Government, Department of Defense, and the Air Force. EA is the tool used to achieve alignment; likewise, the reason for developing IT architecture is to achieve alignment of IT investments and mission objectives. This research groups the best practices into *vision*, *identification*, *framework*, and *governance*. Interestingly, these practices relate to an Enterprise Architecture's depiction of the "to be" target state, the "as is" baseline, the tools and models used for communication, and the motivation and management of the "transition" plan. The insights achieved by this research should strengthen the use of Enterprise Architecture within the Air Force by enabling senior leaders and decision-makers to align strategy and IT investment towards improving mission accomplishment.

Acknowledgements

I would like to thank Dr. John Colombi for his guidance and boundless support. I appreciate the patience, impeccable knowledge, and positive attitude you have shared throughout the course of this thesis effort. I am also indebted to Dr. Alan Heminger, for his eagerness to spread knowledge; Dr. Dennis Strouble and LtCol David Long, who spent their valuable time serving as committee members; and my USAFE points of contact, Mr. Jason Howe and Captain John Belue, for their resourcefulness.

Even though the household got a kick out of turning the tables with questions such as, “How was school today?”, “Did you learn anything?”, and “Do you have any homework?”, my upmost, heartfelt, appreciation goes to my wife and children for their patience and infinite support throughout this endeavor. With a corner filled with your love and encouragement, a guy can’t lose! Thank you.

Mike Fetters

Table of Contents

Page

Page

List of Figures

Page

List of Tables

Page

ACHIEVING ALIGNMENT: AN ANALYSIS OF ENTERPRISE ARCHITECTURE BEST PRACTICES WITHIN THE UNITED STATES AIR FORCE

I. Introduction

Background

The use of Information Technology (IT) in the workplace has become as synonymous as the world's use of the wheel, leaving us unable to picture a world absent of either. Mutually, they create a facilitating foundation, the wheel contributing to the ease of movement, and IT doing its part on our use of information. Like the wheel's limited beginnings of turning pottery, initial implementations of IT focused on dedicated purposes resulting in silo systems whose devoted purpose and functionality made them inapplicable to other aspects of the organization. As can be seen in the tiny gears of a watch or in the construction of a jet engine, progression has taken the wheel and turned it into an intricate part of a greater good. IT has also followed a similar progression, shifting its advancement from a capability to an asset used to structure future strategic opportunities of the organization (Ross, Weill, and Robertson 2006).

Conceptually, the wheel itself is a rather simple contraption. However, when combined with other components to create a more complex system, a plan is necessary to provide structure and orderly arrangement of the inner-working parts. IT, with a capacity to be ingrained throughout our organizations, requires a similar planning discipline known as architecture. This architecture represents the "fundamental organization of a system's components, their relationships to each other and to the environment, and the

principles guiding its design and evolution," (IEEE 2000). Coincidently, this leaves the act of architecting to be relatively known as "the activities of defining, documenting, maintaining, improving, and certifying proper implementation of an architecture," (IEEE 2000).

Knowing where to begin and what to include or exclude from an IT architecting effort requires scoping decisions to ensure the effective representation of resources and an un-wasted effort. These decisions are often based on an enterprise, which represents "an organization, or cross-organizational entity, supporting a defined business scope and mission" (CIO Council 2001). The organization's defined business scope and mission drives the effort, encompassing the coordination of functions and shared information within a particular architecture. Large organizations can be comprised of many sub-enterprises or segments, each executing their individual scope and mission, as well as contributing to, and existing as, part of a larger enterprise. This matryoshka nested doll effect can be seen within the Federal Enterprise Architecture Federation (FEAF) portrayed in Figure 1. Encompassing sub-enterprises as it progresses, the FEAF starts with the nesting of program and node architectures into domain, or functional areas of responsibility (e.g. Finance, Acquisition, or Logistics), and Major Command (MAJCOM) enterprises. In turn, MAJCOM and domain enterprises nest into the AF's service level enterprise architectures of Warfighting, Agile Combat Support, and IT Infrastructure. Topping the sequence are the Department of Defense (DoD) and federal level enterprises respectively. A nested hierarchy of enterprises as described by FEAF facilitates the flow of guidance and represents opportunities for content reuse (DAF 2007).

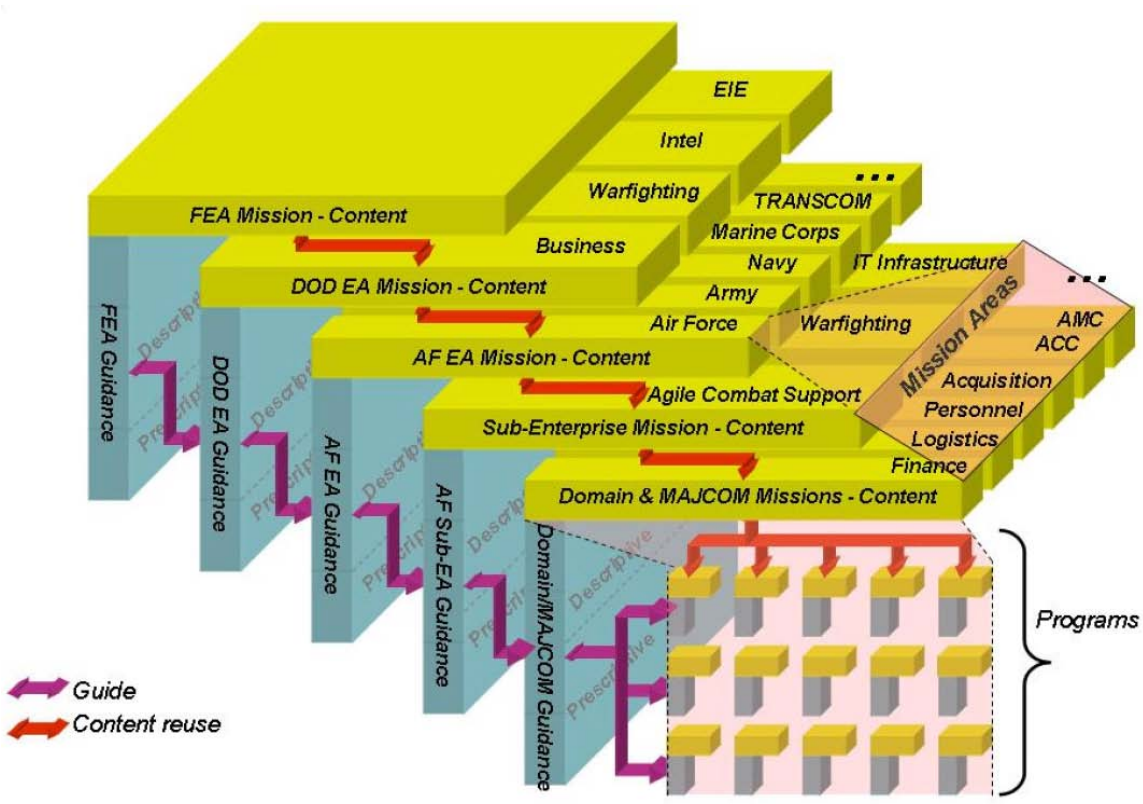

Figure 1: Federal Enterprise Architecture Federation (AFI 2007)

Both the inevitable advancement of technology and the evolving needs of a parenting enterprise depict change. To facilitate this unavoidable notion, a concept depicting the current, target, and transitional process of an architecture is identified within an Enterprise Architecture (EA). An EA represents:

> *a strategic information asset base, which defines the mission, the information necessary to perform the mission, the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs (CIO Council 2001).*

EA represents the logic an organization follows to align its IT and systems with its processes. This produces a synergistic application of business strategy coupled by the advantages of IT application. With this synergy, the predisposition of IT representing

itself as a liability can be re-engineered into leveraging the achievement of mission accomplishment. The realization of this benefit is apparent by the mandate to architect our federal systems and enterprises.

The importance of alignment

Driven by legislation (US Congress 1996) and the expectation of leveraging Information Technology (IT) to align with business, the Federal Government has pursued the act of Enterprise Architecting (EA) for over a decade. Despite the amount of time that has lapsed, the EA maturity to support well informed IT decision-making has yet to be realized (US GAO 2002; US GAO 2008). However, not a new or government-specific problem, the need of achieving IT-business alignment has plagued the minds of IT executives from all industries for almost thirty years (Luftman and Kempaiah 2007). With the desire to fill this need, decision-makers continually search for best practices to help with the alignment of their IT and business organizations (Luftman 2004). Unfortunately, a clear depiction of the nature of alignment is not among the results (Plazaola, Flores, Silva, Vargas, and Ekstedt 2007).

The definition of alignment reflects the application of "IT in an appropriate and timely way, in harmony with business strategies, goals, and needs," (Luftman 2004). Ingrained within this definition is a dualistic view between "how IT is aligned with the business and how business should or could be aligned with IT," (Luftman and Kempaiah 2007). This facet of alignment stands clear amongst those hoping to attain it. Not clear, however, is how alignment is achieved, managed, and maintained (Plazaola et al. 2007).

Luckily, we do not have to define nor design a new process to clear the muddy waters, the resolve is right in front of us.

The achievement and management of alignment exists within the very same entity eluding our Federal Government for the past twelve years, EA. The complex theories and methodologies surrounding strategic IT-business alignment can foundationally be bridged to EA (Plazaola et al. 2007). Words synonymous with alignment, such as integrated, cohesion, and linked can also be found within the descriptions of EA's prescribed benefits of promoting the integration of systems, avoiding duplication, and optimizing mission performance (US GAO 2002).

Numerous directives point the Air Force (AF) towards the creation and use of EAs to deliver a set of living models depicting the complex relationship of current and future IT within an organization. However, the time consuming, resource rich, task of architecting an enterprise requires a pay-off. Private-sector organizations incorporate EAs in hopes to realize bottom-line improvements. Conversely, the Federal Government is comprised of other driving factors making it difficult to determine the same kind of realization of such an effort.

Within the Defense Architecture and AF Architecture Repositories, some AF organizations have strived to obtain compliance with the set directives by initiating and, with varying levels of completion, producing architectural products. Assuming these efforts are initiated with the private sector, bottom-line theoretical uses of EA in mind, perhaps a common theme for the public sector is "what good comes from architecting?" The answer to this quandary is the alignment of the organization's IT with its mission. When the alignment between IT and business is sought, EA is the tool used to define how

that relationship is achieved (Ross 2003). The result of the successful execution of EA is alignment. This research illustrates the benefit of achieving EA alignment by providing foundational research towards its composition as well as assessing the ability of AF doctrine to instruct and assist its accomplishment. The single and recognizable reference towards EA alignment should enable decision makers to apply a synergistic application of strategy and IT towards mission accomplishment.

Research Objectives

The logic of EA, with its goal of aligning an organization's IT and systems with its processes to produce a synergistic application of business strategy coupled by the advantages of IT application, provides a map to the executable nature of alignment. The similarities between these perspectives allude to alignment's ability to reflect the use of EA. IT being an integral part of mission accomplishment and a factor the United States military continually strives to use strategically, a portrayal of a more effective enterprise requires a guideline that can identify EA components that attribute to alignment. Such a guideline will aid in battling the perception that architectural efforts exist as a non-revenue producing expense or an endeavor that does not directly attribute to mission accomplishment as well as entice the use of architectures by promoting the feat of alignment. This research accomplishes this endeavor by answering the research questions surrounding the concept of EA alignment:

1. *What Enterprise Architecture best practices attribute to the successful achievement of alignment?*

2. *What Air Force policy and guidance prescribes and describes Enterprise Architecture usage?*

3. *Does the Air Force Enterprise Architecture policy and guidance adequately capture the concept of alignment?*

Thesis Organization

This research is directed towards DoD architects, IT program managers, Chief Information Officers (CIO), their staff, and executives. It serves as a guide depicting the necessary aspects of EA that contribute to its successful execution, alignment. The remainder of this thesis will report the efforts taken to address the research questions. Chapter II provides a literature review of best practices surrounding the creation of a useful EA, a factor of EA mostly covered by literature (Lagenberg and Wegmann 2004). Chapter III describes and analyzes AF EA guidance on their inclusion of described best practices. Chapter IV applies the described best practices onto a representative IT project, providing a depiction of the implementation of alignment capturing best practices. Chapter V summarizes the research by presenting the researcher's conclusions and recommendations.

II. Literature Review

Overview

In this chapter, a literature review is conducted relevant to the research topics found to contribute to the successful creation and execution of EA. The review indentified several similarities, which allowed for a taxonomy amongst these concepts, as illustrated in Figure 2. The best practices that have shown to contribute to the successful creation and execution of EA are *vision, identification, framework,* and *governance*.

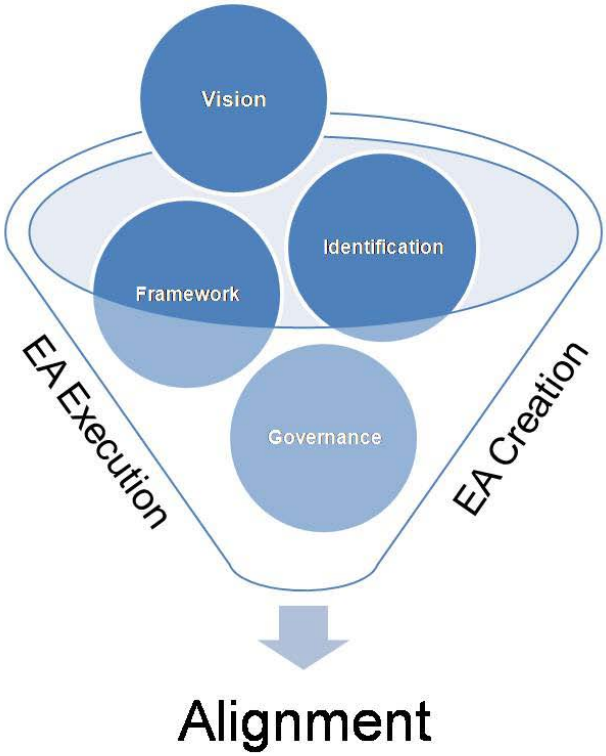

Figure 2: Taxonomy of EA Best Practices Attributing to Alignment

Vision

Architectures are created to provide something of worth. Their result provides a means to an end that should result in better decision-making. The resourceful nature of this capability requires a *vision*. The vision of an EA effort is unique to the owning organization. It ensures all collaborators are synchronized in knowing the stakeholders, the problems, the priorities, and any common IT standards and tools (Armour, Kaisler, and Liu 1999b).

The vision defines the business strategy of the organization and depicts how the enterprise will use IT in support of that strategy (Armour, Kaisler, and Liu 1999a). One method of selecting this vision, yielding a 17 percent enhancement over strategic effectiveness, involves the use of an operating model (Ross et al. 2006). Not clearly defining or selecting an operating model that does not fit results in an organization that jumps from one initiative to another without the potential of leveraging reusable capabilities. By selecting an appropriate level of standardization against an appropriate level of integration, the organization "enables IT to become a proactive—rather than reactive—force," (Ross et al. 2006).

Table 1 represents the characteristics of four operating models an organization may choose to drive their strategic initiatives. The Diversification operating model, consisting of low business process integration combined with low business process standardization, refers to organizations whose business units are related, but not integrated. These business units have few, if any, shared customers, suppliers, or ways of doing business. The Coordination operating model identifies an organization with high levels of business process integration but low levels of business process standardization.

Business units of a Coordination organization generally share customers, products, suppliers, or partners and while their processes are integrated, these units often require unique capabilities. This operating model cultivates process proficiency as well as enhances customer service. The Replication operating model allows business units to be self sufficient of their transactions and data but requires operations to be performed in a highly standardized manner. Success in this type of organization relies on efficient, repeatable business processes. The Unification operating model consists of highly integrated business units with a standardized set of processes. Business units of this type of organization benefit little from self-sufficiency and create efficiencies through integrated data as well as by removing the variability out of processes (Ross et al. 2006).

Table 1: Characteristics of the Four Operating Models (Ross et al. 2006)

Business process integration	Business process standardization: Low	Business process standardization: High
High	**Coordination** •Shared customers, products, or suppliers •Impact on other business unit transactions •Operationally unique buisiness units or functions •Autonomous buisiness management •Business unit control over business process design •Shared customer/supplier/product data •Concensus processes for designing IT infrastructure services; IT application decisions made in business units	**Unification** •Customers and suppliers may be local or global •Globally integrated business processes often with support of enterprise systems •Business units with similar or overlapping operations •Centralized management often applying functional/process/business unit matrices •High-level process owners design standardized processes •Centrally managed databases •IT decisions made centrally
Low	**Diversification** •Few, if any, shared customers or suppliers •Independent transactions •Operationally unique business units •Autonomous business management •Business unit control over business process design •Few data standards across business units •Most IT decisions made within business units	**Replication** •Few, if any, shared customers •Independent transactions aggregated at a high level •Operationally similar business units •Autonomous business unit leaders with limited discretion over processes •Centralized (or federal) control over business process design •Standardized data defintions but data locally owned with some aggregation at corporate •Centrally mandated IT services

Identification

Identification involves defining the current capabilities of the organization's business processes and IT. Enabling descriptions of IT competency would include IT being involved in the development of the strategy, IT understanding the business, and well prioritized IT projects (Luftman, Papp, and Brier 1999). Identification is the starting point of architectural artifact creation and exhibits the relationships information holds throughout the enterprise. Through the discovery of hardware, software, and infrastructure components, potential process effecting capabilities such as the discovery of data repositories and system availability becomes apparent (Armour et al. 1999b).

Other aspects of identifying IT capabilities allow an organization to define a target, which it can tenaciously pursue. As change progresses and new opportunities prevail, the organization "needs to redesign and then implement new systems, processes, and IT infrastructure without sabotaging daily operations," (Ross et al. 2006). Depicting the progression that organizations follow is a common approach known as the "four stages of architecture maturity," (Ross et al. 2006). Within this trend, each stage represents a realization on how to steer an organization's current IT identification towards strategic capabilities. Descriptions of the four stages of EA maturity are:

- *Business Silos architecture:* where companies look to maximize individual business unit needs or functional needs
- *Standardized Technology architecture:* providing IT efficiencies through technology standardization and, in most cases, increased centralization of technology management

- *Optimized Core architecture:* which provides companywide data and process standardization as appropriate for the operating model
- *Business Modularity architecture:* where companies manage and reuse loosely coupled IT-enabled business process components to preserve global standards while enabling local differences (Ross et al. 2006)

It is apparent that the differences between these stages create increased strategic opportunities. For example, the Business Silos stage allows applications to align naturally with a business unit or function. The Standardized Technology stage establishes standards that decrease the number of system platforms, lowering cost. The Optimized Core stage allows organizations to create an enterprise view of data and applications stimulating the reusability of those assets, and the Business Modularity stage allows for strategic agility through customized modules, providing a platform for innovation (Ross et al. 2006). However, organizations are cautioned not to rush through these stages as they represent a natural progression that also requires increased management and governance processes. Trying to implement one without the other can result in failures and delayed benefits. It is also important to keep in mind that large complex enterprises may consist of multiple segmented architectures, each with its own maturity (Ross 2003). Here, an implementation of a technology from the enterprise level may be right for a particular segment of the business, but detrimental to others (Rehkopf and Wybolt 2003).

Framework

Two problems exist when attempting to design and use the architecture of an enterprise. The first problem stems from the natural propensity to model everything. This continual analysis of extraneous architecture artifacts stifles progression, hindering EA effectiveness (Armour et al. 1999b). The second problem is the tendency to model the enterprise piece-by-piece, system-by-system (Zachman 1997). An EA should convey the big picture; it is a system of systems view of the relationships between an organization's primary resources, reflecting how they integrate to drive the strategy of the enterprise (Anaay and Ortiz 2005; Armour et al. 1999b). Capturing this point of reference often requires EA to be depicted by multiple representations, perspectives, or viewpoints. There is a need for consistency within this step. Facilitating this uniformity involves using "a resource that aids in the development or description of an architecture," a characterization found within an architecture *framework* (Siegers 2004).

An EA framework can assist with the capture of involved viewpoints by reflecting the assessment of the Who, What, When, Where, Why, and How surrounding a process. Different viewpoints construed from the same entity reflect the relationships surrounding that entity (Zachman 1999). Several well-established frameworks are in use today, each with overlapping and differentiating aspects. Generally, dissimilarities between these frameworks reflect the specific needs or concerns of the respective realms of business from which they are applied (Urbaczewski and Mrdalj 2006). EA's multi-faceted nature causes it to be characterized as an art as well as a science. The science of EA lies within solution and method-based methodologies represented by experimented and easily certified results, which are found within the standards that define its capabilities and

scientific principles that support its methods. The art of EA can be seen within the consensus of brainstorming and lessons learned. This reflects a process of insight, intuition, and common sense that portrays an individualistic aspect reflected amongst its products (Maier and Rechtin 2002). The chosen EA framework is less important than the information and relationships it captures. Table 2 represents the focus of several popular frameworks.

Table 2: Focus of Various Architecture Frameworks (Siegers 2004)

Framework	Emphasis	What's There	What's Not There
DoDAF	Product Definition	A set of 26 architecture products grouped into 4 architecture perspectives/views.	No detailed methodology guidance
TOGAF	Methodology	In-depth, step-by-step instruction for 'how to' architect	No required architecture products
Zachman	Classification/ Organization	Schema for categorization of 'primitive' architecture information	No required architecture products No methodology guidance
IAF	Classification/ Organization	Schema for categorization of architecture information with apparent Zachman influence	Proprietary framework; scope not known
FEAF	Architecture Components	Broad descriptions of the necessary elements of an architecture and numeric indicators of the architecture documentation's robustness	No specific architecture products No methodology guidance

The framework an enterprise uses should accommodate the organization's vision. This may require a comparison and contrasting of frameworks in order to find the one that provides the best fit (Urbaczewski and Mrdalj 2006). Organizations also have the option of merging existing, or creating new, aspects to their frameworks. Examples of this would be adding new viewpoints to the framework to account for enterprise security or the rationale behind the need for change (Kreizman and Robertson 2006; Robi 2004).

Governance

Creating the right environment to allow the EA to work for the organization is essential. An effective management structure should surround the act of architecting as well as the execution of the IT projects. Creating a foundation for IT project change management structured around using EA requires senior management commitment and support of IT. This type of commitment and support should also establish a common understanding that is communicated frequently (Armour et al. 1999b; Luftman et al. 1999; Armour et al. 1999a; Rehkopf and Wybolt 2003). These are aspects of *governance*. Also reflecting governance is the realization of the importance of the architecture team. Consisting of multiple backgrounds and skill sets, this group requires support as well as organizational freedom (Armour et al. 1999a; Armour et al. 1999b).

Effective governance relates to the management and use of IT within the organization. It depicts "the decision rights and accountability framework for encouraging desirable behaviors in the use of IT," (Ross et al. 2006). Governance does not consist of doctrine alone; it is based on the organization's chosen operating model, or *vision*, reflecting how it operates. EA governance indicates the organizing logic for business processes and IT, enabling the alignment of these two entities (Ross et al. 2006).

The level of governance required to be effective can be related to the architectural maturity of the organization. Figure 3 depicts the type of governance necessary as an organization progresses through the "four stages of architecture maturity" described within the *identification* best practice. Harmonizing the type of governance within the

architecture's maturity represents the capability of strategically capturing alignment (Ross et al. 2006).

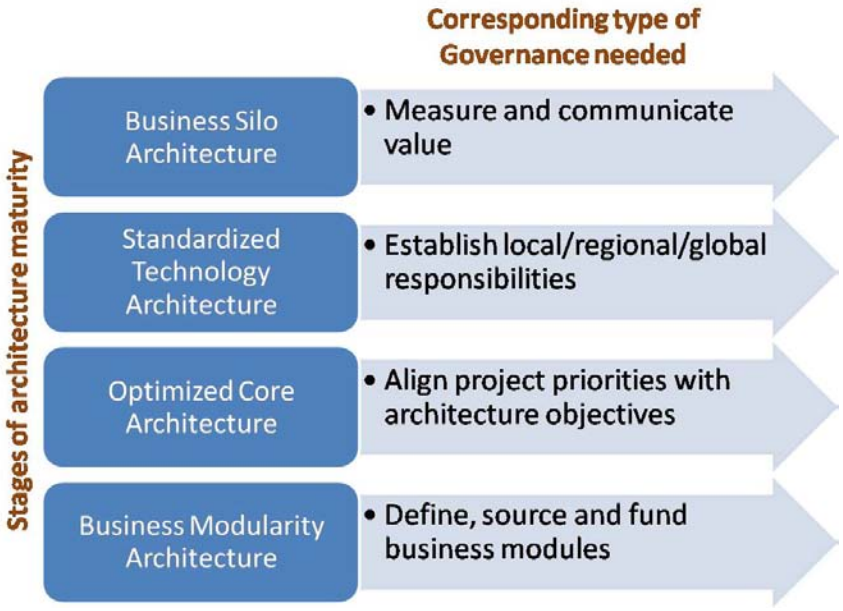

Figure 3: Type of Governance Needed to Correspond with Architecture Maturity

Summary

This chapter identified an aggregation of EA best practices attributing to the successful execution of alignment. The literature search uncovered many other factors concerning alignment including the creation of systematic processes around assessment and maturity models and the construction of heuristics around dimensions of the organization. However, greater emphasis and regularity was found surrounding the chosen four topics. It is through the accommodation of vision, identification, framework, and governance that an organization can drive "IT capabilities to shape business strategy while business strategy shapes IT capabilities," (Ross 2003). Allowing these factors to facilitate an architectural effort establishes an effective EA, providing an executable map towards alignment.

III. Air Force EA Guidance Analysis

Overview

The literature review of the last chapter identified a collection of EA best practices contributing to alignment. The best practices were extracted from the EA body of knowledge, where their usage was studied and effective results verified and reported. A comparable amount of attention has been aimed towards EA within the public sector. This attention has resulted in a considerable amount of EA doctrine and activity from amongst the multiple levels of the Federal Government, based on EA theory that is constantly maturing through experimentation and practice. The direction of this research will now focus on Air Force implementation by first identifying and describing the doctrine that describes and prescribes EA use, and second, by analyzing their ability to capture the essence of alignment.

EA Guidance Summary

Guidance affecting the Federal Government is structured in a hierarchical manner where legislation and federal policies, instilling areas of compliance, are supplemented by subordinate policy and instruction until it reaches an implementation level. The guidance surrounding EA use originates from federal law where it is complemented by the Office of Management and Budget (OMB), the Chairman Joint Chiefs of Staff, the DoD, Air Force Policy, and finally by Air Force Instruction (AFI). Figure 4 illustrates a sample of the guidance examined by this analysis.

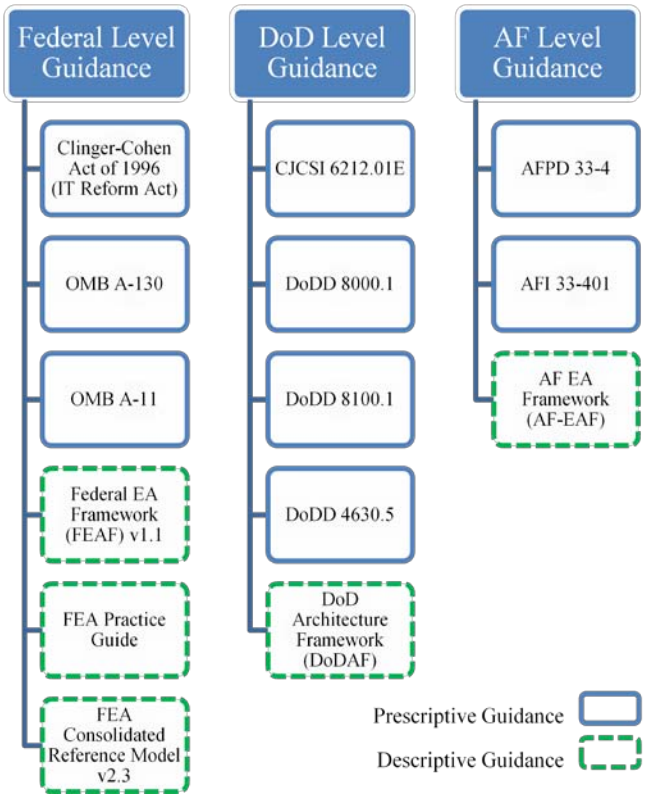

Figure 4: Sample List of Guidance

Federal Level EA Guidance

The importance of structuring IT towards organizational missions and goals has been realized as far back as 1996. The Clinger-Cohen Act (CCA), also identified as the Information Technology Reform Act, directs federal agencies to establish a comprehensive approach towards managing their IT to maximize its use. The CCA stipulates that before the investment in performance supporting IT is made, the processes surrounding agency missions must be reengineered to ensure they support operational goals. A reengineered process ensures effective use of the acquired IT, where goals can be established to improve the efficiency and effectiveness of those operations (US Congress 1996). Central to implementing the transformations called for by the CCA is

the establishment of IT leadership within federal agencies, a feat accomplished by instructing the designation of a Chief Information Officer (CIO). Concerning EA, the CIO is responsible for "developing, maintaining, and facilitating the implementation of sound and integrated information technology architecture," (US Congress 1996). The definition of "information technology architecture" refers to "an integrated framework for evolving or maintaining existing information technology and acquiring new information technology to achieve the agency's strategic goals and information resources management goals," which is concurrent with today's definition of an EA (US Congress 1996).

The CCA also directs responsibility onto the Office of Management and Budget by instructing their use of performance and results-based management within the acquisition, use, and disposal of information technology within the Federal Government. Accommodating this requirement, the OMB established Circular number A-130, *Management of Federal Information Resources,* for the insight of federal information resources. One assumption made by A-130 is:

> *Strategic planning improves the operation of government programs. The agency strategic plan will shape the redesign of work processes and guide the development and maintenance of an Enterprise Architecture and a capital planning and investment control process. This management approach promotes the appropriate application of Federal information resources (OMB 2000).*

A-130 describes an EA to portray "the 'current architecture' and 'target architecture' to include the rules and standards and systems lifecycle information to optimize and maintain the environment which the agency wishes to create and maintain by managing its IT portfolio," (OMB 2000). According to A-130, an EA exists to represent the "explicit description and documentation of the current and desired relationships among

business and management processes and information technology," (OMB 2000). Concerning the EA effort, A-130 facilitates the creation or use of an EA framework to "document linkages between mission needs, information content, and information technology capabilities," and to "guide both strategic and operational IRM planning," (OMB 2000). Through a framework, the EA can then be used to identify and document business processes, identify information flow and relationships, and capture the applications, data descriptions, and technology infrastructure. Compliance with the criteria contained within A-130, summarized in Figure 5, provides the OMB with consideration for continued or new IT investments (OMB 2000). Additional OMB Enterprise Architecture prescriptive guidance can also be found in Circular number A-11, *Preparation, Submission, and Execution of the Budget*. A-11 states that the budget "estimates should reflect your efforts and planned action to strengthen management and improve program performance," and that these "estimates should prioritize and manage E-Government projects effectively through your agency's capital planning process and enterprise architecture," (OMB 2008). It goes on to state that one way to ensure IT investments improve program performance is to ensure it supports the Federal Enterprise Architecture (FEA) (OMB 2008).

Figure 5: OMB Strategic Planning

Providing various methodologies to communicate the organization and relationships of components needed to develop and maintain the FEA, the CIO Council developed the Federal Enterprise Architecture Framework (FEAF) as a tool to engage federal architecture concepts and issues (CIO Council 1999). The FEAF is an EA description, representing "a conceptual model that begins to define a documented and coordinated structure for cross-cutting business and design developments in the Government," and supports interoperability and reuse of information amongst common processes within federal agencies and governmental entities (CIO Council 1999). Capturing sub-architectures, the framework is structured in a segmented manner where focus is placed on major business areas allowing for "incremental development of architecture segments within a structured enterprise architecture framework," (CIO Council 1999). Collectively the interoperable federal segments comprise the FEA.

FEAF utilizes eight components that the CIO council found necessary to develop and maintain the Federal Enterprise Architecture. Descriptions of those components, illustrated in Figure 6, are:

- *Architecture Drivers*: Represents an external stimulus that causes the Federal Enterprise Architecture to change
- *Strategic Direction*: Ensures that changes are consistent with the overall federal direction
- *Current Architecture*: Represents the current state of the enterprise
- *Target Architecture*: Represents the target state

- *Transitional Process*: Apply the changes from the current architecture to the target architecture in compliance with the architecture standards, migration planning, budgeting, and configuration management and engineering change control
- *Architectural Segments*: Focus on a subset or a smaller enterprise within the total Federal Enterprise
- *Architectural Models*: Provide the documentation and the basis for managing and implementing changes in the Federal Enterprise
- *Standards*: Include standards, voluntary guidelines, and best practices, all of which focus on promoting interoperability (CIO Council 1999)

To assist capturing the complexity of these components, FEAF employs a decomposition process, breaking the framework into four progressive stages. The breakdown provides an understandable frame of reference that increases in detail as one progresses the levels and ends with a "logical structure for classifying and organizing the descriptive representations of the Federal Enterprise," (CIO Council 1999).

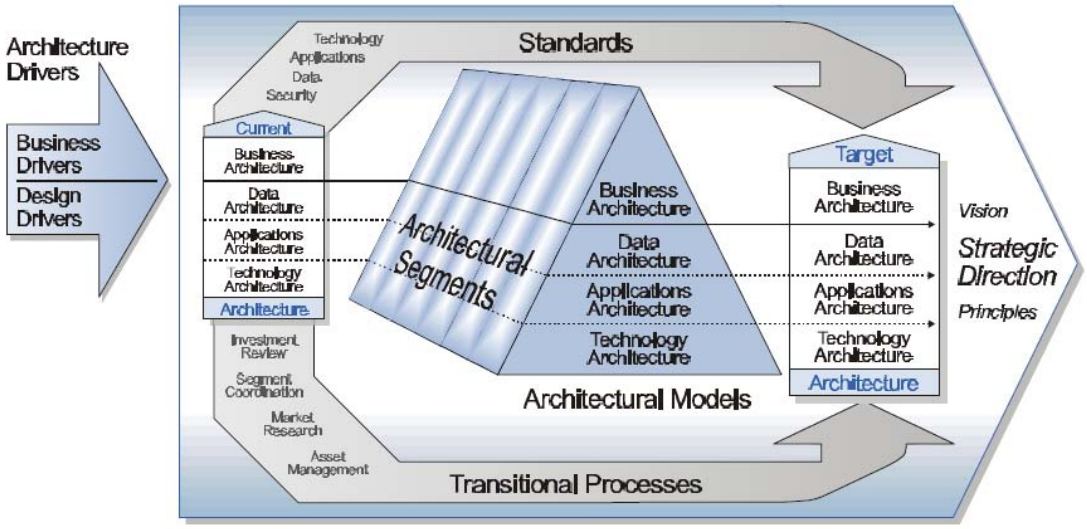

Figure 6: Federal EA Framework Components (CIO Council 1999)

Two other EA descriptive documents are available from the Office of Management and Budget. The first, titled *FEA Consolidated Reference Model Document*, stems from the OMB's Office of E-Government (E-Gov) and Information Technology and contains a description of the architectural models component identified in FEAF. Coined as reference models within the document, they collectively "describe important elements of the FEA in a common and consistent way," (OMB 2007a). The second document, titled *FEA Practice Guidance*, originates from the Federal Enterprise Architecture Program Office of the OMB. This document further describes the FEAF's segmented approach to architecture as well as guidance for developing and using an EA transition strategy. The Practice Guidance also includes a description of methods dedicated towards the capturing and measuring of the value of EA efforts. As "EA should deliver results-oriented products and services to inform business decision and increase the efficiency and effectiveness of IT investments, program management and

agency operations," methods such as these are needed to provide a metric that represents value as well as to identify EA shortfalls and areas for improvement (OMB 2007b).

Department of Defense Level EA Guidance

Instructing the joint environment with the overarching policy to "develop, acquire, deploy, and maintain" IT, the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6212.01E, *Interoperability and Supportability of Information Technology and National Security Systems*, requires EA usage to achieve compliance and Joint Staff Interoperability and Supportability certification. This guideline requires that these architectures meet the operational needs of our forces, are interoperable with existing and proposed systems, are supportable via the Global Information Grid (GIG), are interoperable with our allies and coalition partners, protect mission data, and utilize a common language. CJCSI 6212.01E directs military services and defense agencies to register a scope and content or vocabulary view of their enterprise architecture into the established DoD Architecture Registry System (DARS) where interoperability and stakeholder analysis can take place. CJCSI 6212.01E stresses "interoperability hinges on the alignment of enterprise architectures and solution architectures," enabling a "more detailed analysis of the information requirements," (CJCS 2008).

Establishing policy for DoD IT management, DoD Directive 8000.1, *Management of DoD Information Resources and Information Technology*, directs all DoD components to have a reporting CIO who ensures accurate and consistent information is available to decision-makers in execution of the DoD mission. In support of this mandate an:

> *integrated DoD architecture with operational, system, and technical views shall be developed, maintained, and applied to determine interoperability and capability requirements, promote standards, accommodate the accessibility and usability requirements of reference, and implement security requirements across the DoD enterprise to provide the basis for efficient and effective acquisition and operation of IT capabilities (DoD 2002b).*

Establishing an environment surrounding the DoD enterprise, Directives 8100.01, *Global Information Grid Overarching Policy*, and 4630.05, *Interoperability and Supportability of IT and National Security Systems*, assign the responsibility of all DoD IT missions support to fall under the Global Information Grid (GIG) governing entity. The GIG is directed to consist of a sound and integrated architecture, and the architected assets falling under its umbrella will comply with the components of the GIG's Architecture to sustain a consistent and interoperable DoD enterprise (DoD 2002a). The result of this effort is intended to provide decision superiority to the warfighter and decision-maker by creating a construct that allows for net-centric operations and warfare (DoD 2004).

Understandably, architectures are created with both compliance and practicality in mind. The compliance aspect, driven by law and policy, is represented within this chapter of research. The practical aspect is characterized through experience which:

> *has demonstrated that the management of large organizations employing sophisticated systems and technologies in pursuit of joint missions demands a structured, repeatable method for evaluating investments and investment alternatives, as well as the ability to effectively implement organizational change, create new systems and deploy new technologies (DoD 2007).*

Mindful of both aspects, the DoD Architecture Framework (DoDAF) was created as a guide towards the development of architectures. DoDAF serves as "the guidance and rules for developing, representing, and understanding architectures based on a common denominator across DoD, Joint, and multinational boundaries," (DoD 2007). The guide

achieves a baseline across these boundaries by acting as a descriptive catalog of possible architectural models whose contents provide consistency "across all mission operations and processes, and enabling the integration and/or federation of architecture in support of joint capabilities," (DoD 2007). DoDAF approaches architecting from a data-centric perspective allowing the framework to accommodate the recent net-centric focus of the GIG. Within this perspective, a value-added distinction is made between integrated and federated architectures. An integrated architecture refers to a consistent identification of data elements amongst all of its represented products and views which provides a "broader perspective of the mission by representing data elements through multiple views," (DoD 2007). Federated architectures align dissimilar "architectures and architecture information via information exchange standards…providing a holistic enterprise view that allows for the assessment of interoperability, identification of duplication and gaps, or determination of reusability," (DoD 2007).

DoDAF, the framework in use by the DoD, consists of a data and presentation layer, illustrated in Figure 7. The data layer contains the defining attributes and relationships of the architecture's data elements and the presentation layer reflects "the products and views that support a visual means to communicate and understand the purpose of the architecture, what it describes, and the various architectural analyses performed," (DoD 2007). The products of the presentation layer provide "a way for visualizing architecture data as graphical, tabular, or textual representations," whereas the views "provide the ability to visualize architecture data that stem across products, logically organizing the data for a specific or holistic perspective of the architecture," (DoD 2007). Volume I of DoDAF is dedicated to the definition of those views and

includes descriptions of architecture development, usage, and management. Volume II provides descriptions of each of the data and product types. Volume III describes the aspects that comprise the architecture data management strategy (DoD 2007).

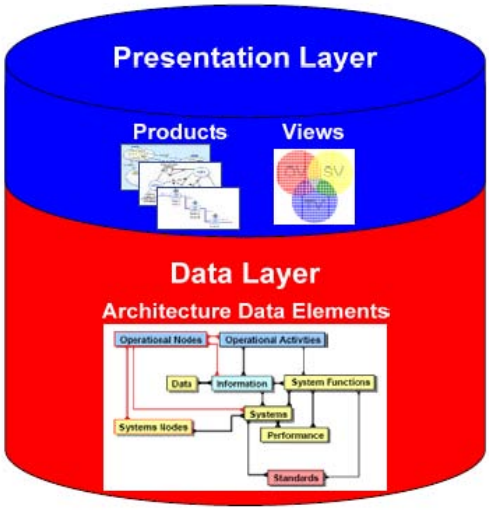

Figure 7: DoDAF Structure (DoD 2007)

AF Level EA Guidance

To assist the management complexity of information and the complex relationships amongst its processes, the Air Force establishes the requirement for EA use in AF Policy Directive 33-4, *Enterprise Architecting*. The guidance directs the AF to use EA as "a decision-support tool to inform, guide, and support the decisions of the Air Force enterprise." Within this context, the AF EA consists of a federation of architectures, or collection of sub-enterprise architectures, whose capabilities are used to "analyze problems, answer questions, guide future actions, and unify capabilities that cut across functional areas to create desired effects," (DAF 2006). Explicitly the AF EA:

> *describes relationships among key Air Force institutional processes to ensure: (1) Alignment of information systems requirements with the processes that support Air Force missions; (2) Adequate Air Force, joint, and allied and coalition interoperability; (3) Redundancy and security of information systems; and (4) The application and maintenance of a set of standards by which the Air Force evaluates and acquires new systems (DAF 2006).*

AFPD 33-4 requires all AF organizations to employ enterprise architecting and requires those architectures to align with the Air Force Enterprise Architecture and its sub-enterprises architectures as well as comply with architectural instructions found in upper level guidance. To enable the integration and reuse of architectural artifacts, AFPD 33-4 calls for the use of common architectural tools and methodologies as well as an architecture repository to house all certified and approved architectures. Major AF Commands (MAJCOMs) provide the oversight of program and lower level architecture activities by establishing policies, procedures, and guidelines to ensure architectures are inclusive and consistent with the AF EA (DAF 2006).

Implementing the requirements of AFPD 33-4, Air Force Instruction (AFI) 33-401, *Implementing Air Force Architectures*, describes the Air Force Enterprise Architecture and assigns responsibility for its federated architectures. AFI 33-401 describes the AF Enterprise Architecture as utilizing a federated approach, which consists of "nested" architectures. Representing the lowest level is program architectures, which are a part of, and conform to MAJCOM architectures. MAJCOM architectures then federate with other sub-architectures to create the AF EA, which also "nests" into the larger DoD and Federal Enterprise Architectures, as depicted in Figure 1. The purpose of this approach prevents duplication and ensures the development of architectures support decision-makers at all levels (DAF 2007). In addition to establishing architecting roles

and responsibilities for the Air Force, AFI 33-401 also implements a governing set of processes, "structured to oversee the development, alignment, certification, maintenance, and application of the AF EA and subordinate architectures," (DAF 2007). Accommodating the architecture certification and approval requirements found in CJCSI 6212.01D and DoDD 4630.5, AFI 33-401 provides avenues that "provide for the quality control and configuration management of the architecture, alignment with appropriate higher-level and 'peer' architectures, and the accuracy and applicability of user activities," (DAF 2007). The AFI also directs the creation of the Air Force Architecture Repository System to serve as the authoritative source for AF architecture artifacts.

Leveraging aspects of DoDAF and the FEA reference models found in the Federal Enterprise Architecture Framework, AFI 33-401 establishes the AF EA Framework (AF EAF) to provide "the logical structure for classifying, organizing, and relating the breadth and depth of information that describes and documents the AF EA," (DAF 2007). The AF EAF consists of the architectural aspects that contribute to the creation and integration of AF architectures and suffices the EA requirements set forth by OMB Circular A-130. The AF EAF, illustrated in Figure 8, consists of three parts. Conjoined they embody guidance drivers and inputs, the description layers or perspectives that relate to a "full-spectrum" of architecture products and artifacts, and the uses and impact of the AF EAF (AF CIO 2003).

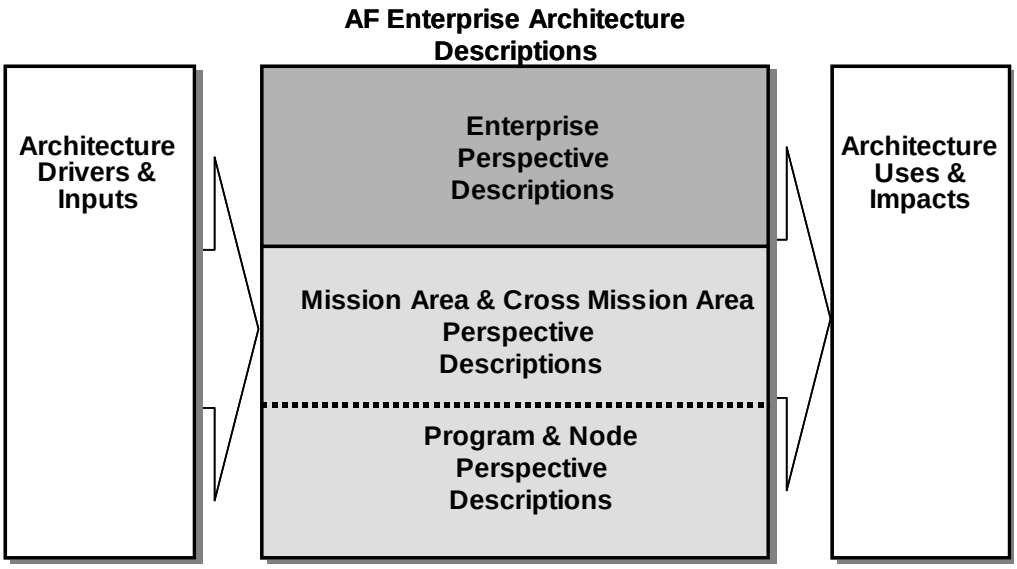

Figure 8: AF EAF Overview (AFI CIO 2003)

EA Guidance Analysis

The topic of EA has been well thought out by the governing bodies of the Federal Government as represented by the large sample of EA guidance contained in the summary. However, despite these efforts, overall EA effectiveness ranks low and does not support informed IT decision-making, and the true achievement of alignment remains doubtful (US GAO 2002; US GAO 2008; Plazaola et al. 2007). These issues prompt the question, "Does the guidance contrive to the effective use of EA and attribute to the achievement of alignment?" The remainder of this chapter consists of an AF-level guidance analysis on the inclusion of the EA best practices identified by the literature search of this research.

Vision

Generally, the guidance contained in the summary spelled out those responsible for ensuring a sound and integrated architecture, defined its boundaries, and established constructs to manage it (US Congress 1996; DoD 2002b; DoD 2004). In review, an EA *vision* defines how the enterprise will use IT in support of strategy. This topic was pervasive and clear throughout the Air Force (and higher) guidance, as can be seen in the FEA vision to:

> *develop, maintain, and facilitate the implementation of the top-level enterprise architecture for the Federal Enterprise. This architecture will serve as a reference point to facilitate the efficient and effective coordination of common business processes, information flows, systems, and investments among Federal Agencies. In time, Government business processes and systems will operate seamlessly in an enterprise architecture that provides models and standards that identify and define the information services used throughout the Government (CIO Council 1999).*

Collectively, the analysis discovered the AF EA vision establishes the purpose for the architecture's existence. It calls for the EA to inform, guide, and support key decision-making processes through means that determine interoperability and capability needs. Specifically in strongly networked environments, many of the distributed, programmatic decisions involve allowing information to be "visible, accessible, and understandable to any authorized user," (DoD 2007; DAF 2006; DoD 2004). The architecture does this by acting as a living representation of the enterprise, reflecting how the mission is performed, how the information is consumed and produced, and how its enabling technologies are implemented, effectively attributing to the Air Force's ability to achieve information superiority (DoD 2007; DAF 2007).

Referring back to the operating models, illustrated in Table 1, this analysis identifies the AF as utilizing the Coordination operating model to drive its IT strategy. Although the operating model is not actively identified and pursued, the AF's nature to use IT to achieve high levels of integration where customers, products, suppliers, and partners are shared and whose business units have unique operations and capabilities places it within this category. With the ability to succeed being supported by matching a defined operating model to growth, the AF could benefit by structuring the strategy of its potential IT growth after an operating model that not only focuses on integration, but process standardization as well. A strategy built on both components allows organizations to leverage IT into a more proactive manner (Ross et al. 2006).

Identification

Through EA *identification*, an organization captures a description of their IT architecture and processes allowing them to conjure an assessment of how well IT is assisting processes in the accomplishment of the mission and develop a roadmap to drive future IT efforts. The guidance analysis discovered that reengineered business processes are a forceful factor behind ensuring IT is applied effectively within the AF. In conjunction with ensuring AF processes are efficient, the described EA efforts found within the guidance stipulates that the IT applied to those processes are interoperable, integrated, and federated. The given benefits of these actions allow architectures to be identified within a similar plane of existence. Utilizing the assessment of the four stages of architecture maturity described in the identification best practice of Chapter II, this state of an architecutre represents a Business Silo maturity where data and performance is

locally maximized and the architecture does not constrain IT implementation (DAF 2007; Ross et al. 2006).

This level of maturity involves implementations driven by the design of a process where IT is then developed or purchased to fulfill the functionality of that process. Benefits of this stage of architecture maturity include a 100 percent solution provided to the business need and a naturally aligned IT and business unit. The disadvantage of this stage of maturity is that it results in the creation of legacy systems that cannot communicate with each other without the costly intervention of software programmers, hindering process integration and standardization. The primary reason to progress past this maturity stage is the large cost inherent with legacy systems. Organizations warranting IT efficiency and a solid data and process platform seek to move to the Standardized Technology stage of architecture maturity. Within this stage, the role of IT remains the same, which is to automate local processes, however, the emphasis on the management of IT changes from ensuring functionality towards providing cost-effectiveness and reliability (Ross et al. 2006).

Recent Air Force IT initiatives such as server consolidation, E-mail for Life, and the Standard Desktop Configuration reflect attributes from the Standardized Technology architecture maturity phase, such as IT efficiencies being provided through standardization, an emphasized IT management, and increased centralization and access to shared data. However, the question remains if these programs are driven by the architecture or are representative of other dealings. A search of AF IT initiative documentation concluded that these initiatives were not contrived from the guidance. Although the inherited use of EA captures the “as is” state of an architecture, an

additional enterprise-wide IT architecture identification could be beneficial to propel strategic capabilities.

Framework

Through a chosen EA *framework,* a consistent representation of the relationships of an organization's resources is shared, collectively describing mission accomplishment despite the inherent multiple views or perspectives. The guidance analysis identified three frameworks having prescriptive effects on Air Force programs today. They consist of the Federal Enterprise Architecture Framework, the DoD Architecture Framework, and the AF Enterprise Architecture Framework. The most prominent level of guidance directing Air Force enterprises, the AF EAF, leverages aspects from both the FEAF and DoDAF in support of the AF's "vision, mission, transformational objectives, and operational concepts," (AF CIO 2003). Specifically it "provides the logical structure for classifying, organizing, and relating the breadth and depth of information that describes and documents the Air Force Enterprise Architecture," (AF CIO 2003). Focusing directly on a framework's purpose, the AF EAF supports:

- Alignment of requirements for information systems with the processes that support the AF missions
- Adequate AF, Joint, and combined interoperability
- Integration, assurance, and security of information systems
- Prioritized allocation of resources to critical capabilities
- The application and maintenance of a set of standards by which the AF evaluates and acquires new systems (AF CIO 2003)

Governance

As stated earlier, effective governance relates to the management and use of IT within an organization. Inherent to this definition and a factor documented by the GAO to be the most lacking within the DoD, is an attitude influencing EA to extract desirable behaviors from IT (US GAO 2008). Throughout the referenced guidance, the designation of "governance" was commonly used to refer to the oversight of EA use as well as to describe its apparent benefits. However, absent from this depiction of "governance" is an EA endorsing environment consisting of allocated resources, management importance, or the need for culture change. Best practices describe governance structures to consist of IT investment management processes, communication strategies, ownership, and accountability. However, this aspect of alignment appears most lacking amongst the guidance (US GAO 2008). For the military, an attitude supporting governance needs to be fueled with commander's intent to facilitate the alignment of IT with mission, not with just words of guidance, but with action.

Summary

This chapter identified and described the different guidance within the AF contributing to the prescription and description of EA use. Considering the low effectiveness of EA throughout the Federal Government, a review and assessment was performed on the guidance's inclusion of aspects attributing to EA alignment (US GAO 2002; US GAO 2008). The search revealed that the Air Force's IT is not driven by its EA. An identified operating model could be used to drive the application of IT towards the AF's vision and allow for an assessment of those assets as they apply towards that vision and mission accomplishment. The analysis also found attitude, a factor of the governance best practice, to be missing from the guidance. The attitude needed is one that would encourage action and affect decision-making on all levels in order to facilitate the EA vision.

IV. Analysis of Alignment

Overview

An effective EA reflects the essence of alignment by facilitating the application of IT in accord to an organization's strategies, goals, and needs (Luftman 2004). The benefit of such facilitation increases integration and decreases the duplication of processes and systems, optimizing mission performance. These resounding results echo throughout the enterprise affecting continued and new implementations of IT (US GAO 2002). The validity of this concept is apparent when observed from the context of an IT project.

In this chapter, a case study is presented representing the depiction of a typical, large-scale deployment of an enterprise software application. The case study gauges the applicability of the four EA best practices *vision*, *identification*, *framework*, and *governance* towards a real-world example with the expectation to represent their merit towards alignment. The information describing the representative IT project portrayed in this case study was derived from the Chief Information Office (CIO) Support Branch and Knowledge Operations section of Headquarters (HQ) United States Air Forces in Europe (USAFE), Ramstein Air Base, Germany.

Project Background

This particular IT project began as a requirement originating from USAFE's HQ Office of the Director of Staff (DS). Details of the requirement consisted of solving the task management problems experienced throughout USAFE by selecting a solution that

has the capability to serve as an enterprise-wide task management standard. Current task management practices consist of arbitrary processes that span across the command. Their deficiencies do not provide for status visibility or collaborative opportunities and adversely affect the storage and rapid discovery of information. Further advocating the need for a new tool, the current processes and tools do not contain the scalability needed to serve as an enterprise-wide task management standard. The team constructed to solve this issue consisted of individuals originating from USAFE DS, HQ USAFE Directorates, and Microsoft Process experts (Belue 2008).

Capturing the Process

USAFE exercises a strategic plan that includes the presence and infrastructure to enable access throughout their area of responsibility. Access, in this case, refers to such things as the access used to enable mission accomplishment and the access that enhances the interoperability with partners and allies. Access is paramount to USAFE's ability to project power. This depiction of presence and infrastructure can be transposed onto many USAFE assets, including their utilization of IT. USAFE consists of roughly 35,000 users spread out amongst 16 different installations (Belue 2008). Their ability to execute their strategic plan provides the interoperability of these sites.

USAFE supports downward directed Air Force Smart Operations 21 (AFSO-21) initiatives. The program management team assigned to solve the task management dilemma began by collecting detailed information regarding the task management problem as well as details of the required solution. This was accomplished through the

initiation of an AFSO-21 influenced Lean Six Sigma analysis on the current USAFE task management process. The analysis concluded:

- Subject matter experts (SME) indicated that less than 31% of the current task management processes are effective
- SMEs indicated that current technology support meets the task management process needs less than 47% of the time
- SMEs indicated that less than 59% of the current task management processes are effective (Conway 2006)

Concurrent with the Lean Six Sigma analysis, the team initiated a pilot study to collect data from interviewed functional and operational leaders from around USAFE. The results of interviews conducted as part of this pilot study allowed for the creation of a ranked list of goals to which the new solution must adhere. The captured goals require the tool to accommodate:

1. Collaborating with others
2. Content related data transfer, sharing and tracking among different functional areas at the appropriate security levels
3. Finding and retrieving information
4. Communicating required information for approvals (Conway 2006)

Collectively, the information from their analyses provided the program management team with the insight to rank visibility and efficiency as the key elements needed to improve the current task management process. Structured around this realization, the team developed a way-ahead solution calling for a dynamic, commercial

off-the-shelf tool that can be easily integrated with the enterprise architecture and applications currently in place (Belue 2009).

Integrating with Existing IT

Driven by their strategic plan, USAFE's IT infrastructure supplies sufficient connectivity to provide the interoperability with multiple installations and is supportive of an enterprise-wide solution. The program management team utilizes existing architectural diagrams, shown in Figure 9, to identify and assess the capabilities of USAFE's enterprise services and applications. The information provided by drawings such as these provide the team with the interfaces, architecture, and infrastructure the new solution must integrate with in order to adhere to the business scenarios created from the ranked list of requirements (Conway 2006).

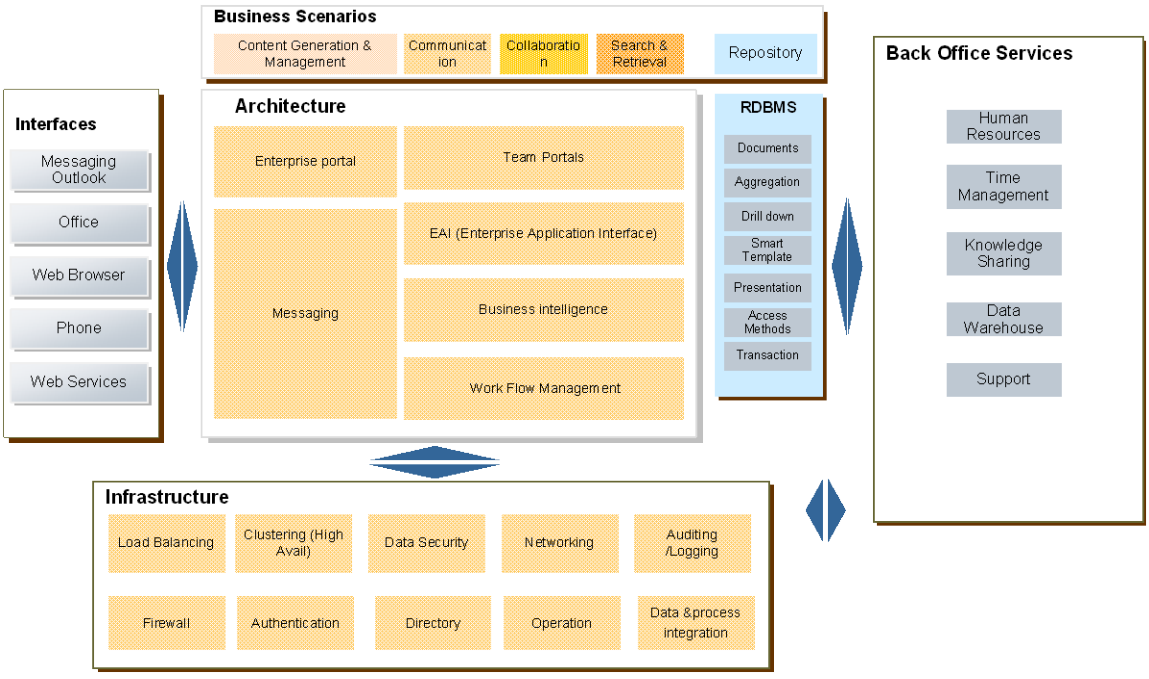

Figure 9: USAFE Enterprise Services (Conway 2006)

Other information made available to the team consisted of diagrams depicting the players and flow of information surrounding the current USAFE task management process, illustrated in Figure 10. The information obtained from these architectural artifacts identifies the flow of a task as it progresses from the office of the USAFE Director of Staff (DS) throughout the rest of the command (Belue 2009).

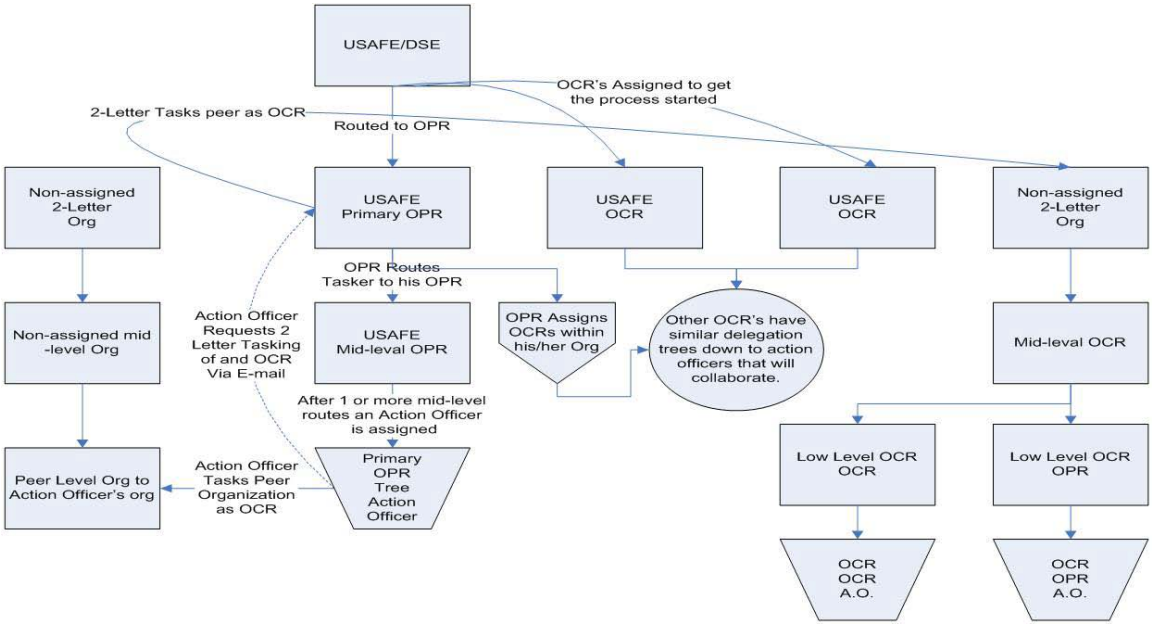

Figure 10: USAFE Task Process Flow Identification (Belue 2009)

The program management team also initiates an audit capturing the specific activities different types of enterprise users engage in throughout a given workday. The audit consists of capturing the percentage of time each type of user performs tasks associated with the goals driving the new solution. The result of the audit, illustrated in Figure 11, is useful towards identifying gaps and provides a starting point for investigating how information supports worker enablement (Conway 2006).

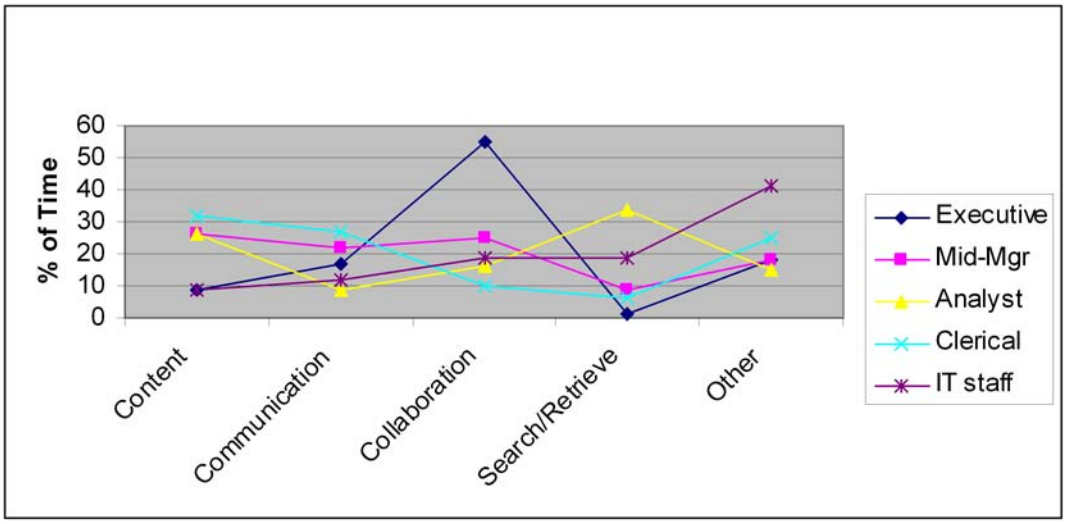

Figure 11: Identification of Users and their Task Profiles (Conway 2006)

Capturing Project Requirements

The information collected up to this point allows the program management team to separate the USAFE task management process into three procedures or work scenarios. The new solution must account for all three procedures to capture every facet of the task management process. The first, consisting of administrative task management, surrounds the procedures accomplished by USAFE DS in regards to task initiation, timeline determination, selection of the Office of Primary Responsibility (OPR), and tracking of the task until completion. The second task management procedure, operational task management, consists of tasks such as receiving the task from USAFE DS, establishing a task definition, and selecting the organization that will work the task and create the deliverable. The third task management procedure is a Request for Information (RFI) based work process. This procedure involves providing answers to time-sensitive ad hoc

or routine requirements as well as directing the production of intelligence information or products (Belue 2009).

The project management team captures each of these work scenarios into a workflow diagram to relate the players, information, and the tasks involved. As can be seen in the illustrated operational task management procedure of Figure 12, these process diagrams allow the program management team to identify parts of task management that create lost value or wasted effort, ensuring these issues are avoided in the new solution (Belue 2009).

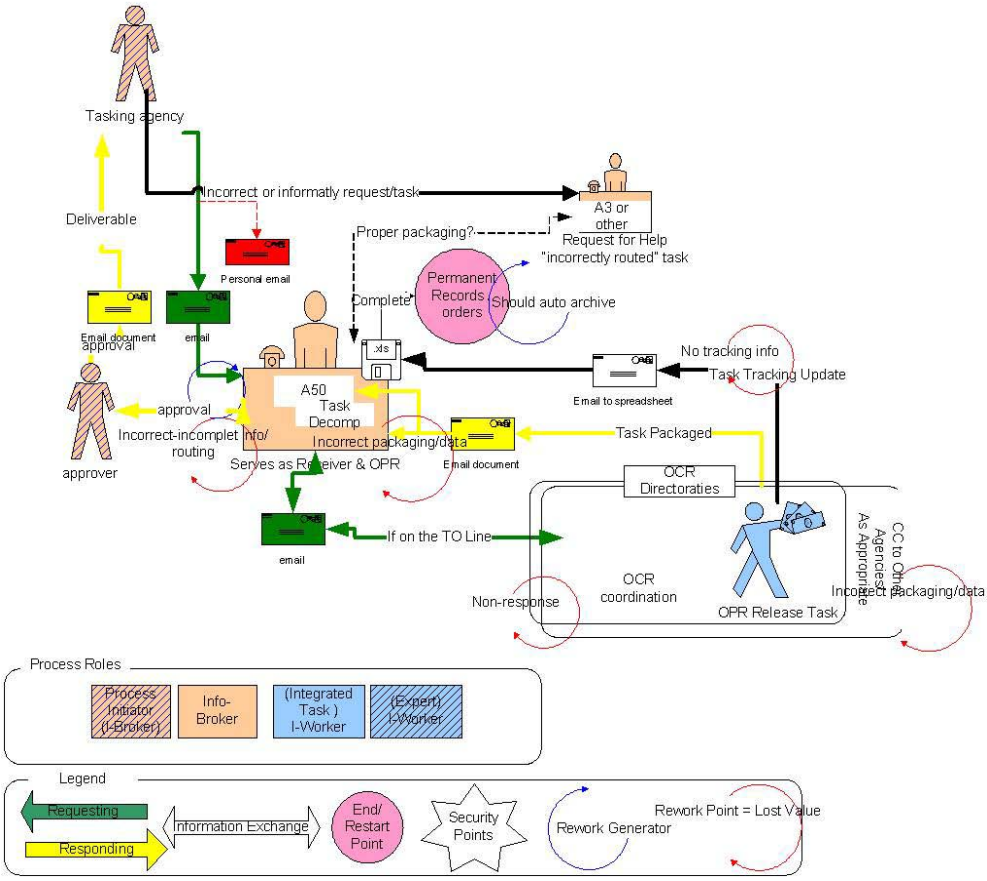

Figure 12: Operational Task Management Procedure (Conway 2006)

Implementing the Solution

The requirement to solve the task management issue is well known throughout USAFE. The program management team experienced the necessary organizational freedom to collect the analysis data needed to improve the process and acquire a suitable solution. As a result, the selected resolve consists of a multiple layered enterprise-wide solution of capabilities derived from incorporating the already implemented AF standard Enterprise Information Management (EIM) solution as well as new features obtained from Microsoft's Customer Relations Management (CRM) software solution (Belue 2009).

The AF EIM solution consists of a Microsoft SharePoint suite, which provides the foundation for document sharing and collaboration throughout USAFE, as well as a SQL database providing management of all data. The Microsoft CRM tool provides the capability to project enterprise-wide visibility of cross-functional mission efforts. Collectively, the system of systems encompassing the entire solution is the USAFE Task Management Tool (TMT) (Belue 2009).

The TMT solution, illustrated in Figure 13, provides the capability that begins with the initiation of a task that has to be coordinated through the Staff or Wings within USAFE. Someone, normally the DS or Executive Officer initiates the task by clicking on the CRS provided button within Microsoft Outlook to create the core pieces of the task and load the applicable attachments into the repository of the EIM. The task is then routed to an OPR and one or many Office(s) of Collateral Responsibility (OCR) that can then assign it to Action Officers (AO) for action. Upon completion, the task is staffed back up the chain for approval and eventually released by the generating Authority.

TMT as a whole provides the capability of tracking task progression via real-time visibility of assigned or open tasks anywhere throughout USAFE (Belue 2009).

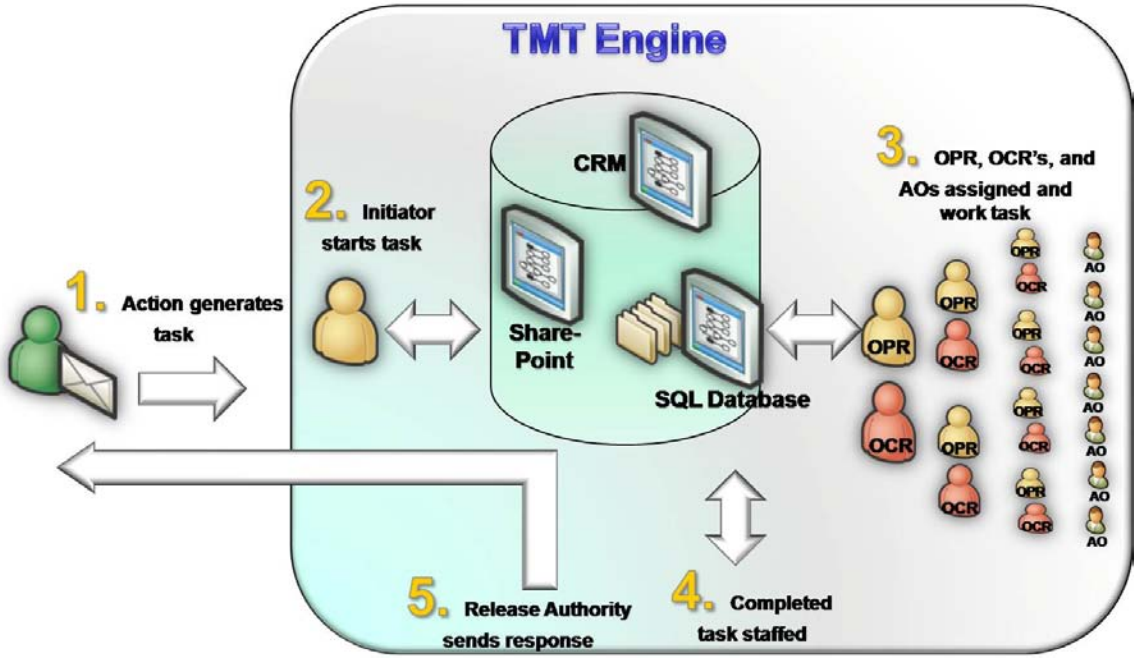

Figure 13: USAFE Task Management Solution based on Microsoft CRM and AF EIM solution (Belue 2009)

Implementation of the TMT solution was consistent of an iterative development process, which creates and tests sequential builds repeatedly, until it sustains stability standards. As a result, TMT data is captured centrally into a repository where data queries can be tailored, streamlining task reporting at multiple levels throughout the command. Along with the task management advancements the tool provides, other processes throughout the enterprise, such as communications requirements, training, metrics gathering, and trouble ticket management, can leverage the now in place CRM capabilities to reengineer their processes. A replication of these process improvements could be benchmarked and incorporated Air Force-wide (Belue 2009).

The TMT solution did come at a cost. In addition to the initial start-up cost, annual operation and maintenance costs are also incurred. Justification of the cost is that the TMT solution will provide USAFE:

- A savings of over 18,000 man-hours a year
- Collaborative benefits that reduces rework at all levels of the command
- 100 percent tasker visibility throughout the command
- Reduction of data storage by more than 60 percent (Belue 2009)

Through cost avoidance and the benefits just described, USAFE plans to receive a return on their investment in just three years (Belue 2009).

Project Retrospective

The EA best practices, *vision*, *identification*, *framework*, and *governance*, can become apparent within project execution when the enterprise within which they operate consists of IT that is aligned with the mission as well as a mission that is aligned with IT (Luftman 2007). The task management project is representative of this fact. The project operates within an environment that utilizes an information production line that delivers tangible results that drive the business. Technology is used to create, modify, and utilize information that in turn creates products or services for their customers. The value of this information work is a product of the cost of worker enablement. This enablement process entails ensuring the right processes are in place, the right procedures are known, and the right technologies are used. The four EA best practices can provide prospective and retrospective effects. As the project is planned and implemented, they guide the project to ensure it is aligned with the enterprise. After the project is implemented, the

best practices can serve as an assessment tool, evaluating the project's ability to align itself within the enterprise. The descriptive details of the task management project demonstrate this ability.

When reviewing the task management project, USAFE did not utilize an operating model to define a definitive *vision*. However, components of their strategic plan facilitated the task management solution to create a cross-utilization of process integration and process standardization, reminiscent of the Unification Operating Model described within the *vision* best practice of Chapter II. The characteristics of this operating model, listed below and illustrated in Table 1, coincide with the capabilities of the TMT solution:

- Globally integrated business process with the support of enterprise systems
- Business units with similar or overlapping operations
- Centralized management often applying functional, process, and business unit matrices
- High-level process owners who design standardized processes
- Centrally managed databases
- IT decision are made centrally (Ross et al. 2006)

USAFE also accounts for components of the AF-wide *vision* within its decision-making processes. Suggestive of this fact is the MAJCOM's acquiescence with Air Force AFSO-21 initiatives and USAFE's ability to create parallelism between the task management requirement of worker enablement and AF EA usage. Worker enablement, which again consists of ensuring the right processes are in place, the right procedures are known, and the right technologies are used, coincides with the AF EA consisting of

reflecting how the mission is performed, how the information is consumed and produced, and how its enabling technologies are implemented (DAF 2007).

During the analysis of the captured information, the project management team *identified* the current task management process as well as the current capabilities of USAFE's IT. Figures 9, 10, and 11 are representative of this statement. Although an actual architecture maturity assessment was not conducted on the USAFE EA, the captured hardware, software, and infrastructure represented in these architectural artifacts shows that the task management process favors the Optimized Core architecture described in the *identification* best practice of Chapter II. This type of architecture supports organizational wide data and process standardization (Ross et al. 2006). Retrospectively, the architecture surrounding the task management process consists of the sufficient connectivity and suite of enterprise services to support the operation and maintenance of the TMT solution.

The methods used to construct the diagrams found in Figures 9 through 13 do not necessarily coincide with the definition of products found within DoDAF or the AF EAF. However, they do reflect *framework* views. The USAFE diagrams reflect the art of EA discussed within the *framework* best practice of Chapter II. Through the experience, insight, and common sense of the program management team a subtle framework was established that ensured the analyses of the previous task management process effectively captured key customers, linked and standard processes, shared data, and linked automating technologies (Ross et al. 2006). The value of these diagrams lies within their ability to capture the relationships and information surrounding the task management process.

As stated earlier, the TMT solution solved an issue that was shared by many and well known throughout USAFE. As a result, the project experienced appropriate organizational freedom to collect the necessary data, which resulted with a solution that aligned the goals of the solution with the objectives stated in USAFE's strategic plan. These important factors of *governance* resulted in a solution that not only solved the task management problem, they also put into place the technology that other USAFE processes can leverage to bring forth more capabilities and a greater return on investment. The ability of TMT to align with the needs of the task management process, and other similar processes being able to align with TMT, portrays the very nature of alignment.

Summary

The resounding results of alignment echo throughout the enterprise affecting continued and new implementations of IT. The validity of this concept is apparent when observed from the context of an IT project. This chapter presented a typical, large-scale deployment of an enterprise software application shown to exhibit aspects of the EA best practices, *vision, identification, framework,* and *governance*. The portrayal of alignment represented within this chapter complements the descriptive trend of this research by presenting the applicable nature of these best practices and creating a self-actualization of alignment's inherent benefits.

V. Conclusions and Recommendations

This chapter presents conclusions attained as a result of this work and then addresses suggestions for future research.

Conclusions

This research uncovers areas of best practices that support achieving alignment between an organization's IT and its business processes. One principal finding of this effort revealed that the best practices contributing to alignment exist as characteristics of Enterprise Architecture (EA), a common practice found throughout the Federal Government, Department of Defense, and the Air Force. EA is the tool used to achieve alignment; likewise, the reason for developing architecture is to achieve alignment of IT investment and mission objectives.

Information Technology has become an integral part of mission accomplishment and a factor the United States military continually strives to use strategically. The logic of EA, with its goal of aligning an organization's IT and systems with its processes, provides a map to the executable nature of alignment. This research serves as a guideline towards alignment. Its application should strengthen the use of Enterprise Architecture within the Air Force by enabling senior leaders and decision makers to align strategy and IT investment towards improving mission accomplishment.

This research accomplishes this endeavor by answering the following research questions surrounding the concept of EA alignment.

1. *What Enterprise Architecture best practices attribute to the successful achievement of alignment?*

With the realization of Enterprise Architecture's ability to contribute to the achievement of alignment, this research began with the literature review of Chapter II. The goal of the review was to search the EA body of knowledge for topics relevant to the successful creation and execution of EA. The review concluded with a taxonomy of concepts, portrayed in the aggregated EA best practices of *vision*, *identification*, *framework*, and *governance*.

Within the context of EA best practices attributing to alignment, *vision* refers to the definition of an organization's strategy, depicting how IT will be used in support of that strategy. Organizations utilize an operating model, consisting of a determined amount of process integration and process standardization, as a method to define the vision for the enterprise. *Identification* consists of capturing the capabilities of the organization's processes as well as their IT. Through identification, organizations assess the maturity of their architecture and determine how to steer their IT to accommodate it. Such identification can include application licensing, server utilization, networking requirements, commercial services, and data management. The *framework* best practice refers to the application of a defined architectural framework towards the capturing of an organization's processes and IT. In a consistent manner, the framework ensures accountability of the many perspectives that exist within an enterprise and captures the relationships shared amongst its vast resources. *Governance* represents the creation of a proper enterprise environment, where EA is allowed to work for the organization. Aspects of effective governance are management commitment towards the use and creation of EA as well as the realization and support for the capabilities of IT to leverage mission accomplishment. Interestingly, the best practices identified by the literature

review relate to an Enterprise Architecture's depiction of the "to be" target state, the "as is" baseline, the tools and models used for communication, and the motivation and management of the "transition" plan.

2. *What Air Force policy and guidance prescribes and describes Enterprise Architecture usage?*

The first instance of policy directing EA use within the Federal Government was created in 1996 with the Clinger-Cohen Act. Since that time, a considerable amount of attention has been directed towards EA resulting in a constellation of policy and guidance regarding its use and execution. The opening of Chapter III identifies the applicable policies and guidance that describe and prescribe the use of EA within the Air Force.

Throughout the identification of applicable policies and guidance, an area for discussion concerned the distinction of which level of policy was applicable to whom and which was not. The sheer amount of policy and guidance within the area of EA contributes to a complicated set of convoluted processes making its effective accomplishment seem impossible. To simplify matters, a clarifying distinction can be made that a particular architecture effort is only required to comply with the level of guidance that governs their use of EA. Ensuring the alignment and federation of subsequent enterprises in accordance with higher-level guidance and governance is the responsibility of an owning architecture. For instance, a program level architecture such as the one described by the USAFE TMT solution complies and aligns with its owning MAJCOM policies regarding architecture certification and approval. The next level of applicability is the responsibility of the owning MAJCOM or domain level architecture, which in this case is the USAFE enterprise, to ensure subsequent enterprises comply and

align with AF EA policies and governance, which they pursue through specified channels for certification and approval.

It is also important to note different organizations utilize different or varying degrees of multiple frameworks. An example of this can be seen within the AF EAF. The AF EAF creates its own distinct framework characteristics while also leveraging aspects of DoDAF and FEAF. Pinpointing the aspects of the assigned framework also helps with simplifying the large amounts of EA guidance.

3. *Does the Air Force Enterprise Architecture policy and guidance adequately capture the concept of alignment?*

Despite the amount of years contributed towards EA work and regardless of the time and effort associated with the creation of the prescriptive and descriptive policy and guidance, all levels of the Federal Government routinely receive low EA effectiveness rankings (US GAO 2002; US GAO 2008). This issue provided the motivation for the Chapter III analysis of EA guidance and policy on the DoD's ability to capture the essence of alignment represented by the taxonomy of the EA best practices. As the achievement of such policy and guidance seeks to "effectively establish and leverage enterprise architecture as instruments of organizational transformation," the results of the analysis acknowledged several identifiable gaps (US GAO 2008).

The gaps identified by the analysis revealed that the majority of the Air Force's IT is not driven by an EA. In regards to the *vision* best practice, the AF operates within an IT operating model focused primarily on the integration of processes and systems, resulting in IT only responding reactively to the integration of new and existing systems and processes. By actively defining and pursuing an EA vision that not only focuses on

integration, but process standardization as well, will allow IT to be leveraged proactively in the pursuit of mission accomplishment.

The *identification* of the Air Force's IT and processes uncovers an enterprise where performance is locally maximized and where IT does not drive or restrain IT implementation. The ability to identify an architecture's level of maturity allows for the assessment of associated benefits, which come with that particular level of maturity, to ensure they are consistent with the chosen EA vision. Comparing the characteristics of this best practice with the deliverables of EA use described by the AF guidance and policy, this is not where the AF wishes to be. Providing additional reason to pursue a greater level of architectural maturity is the ability to realize greater IT efficiency through cost-effectiveness and reliability, a solid data and process platform, and a reprieve from the large cost associated with legacy systems (Ross et al. 2006).

Frameworks are evident throughout AF policy and guidance. Their purpose "provides the logical structure for classifying, organizing, and relating the breadth and depth of information that describes and documents the Air Force Enterprise Architecture," which is consistent with the framework best practice (AF CIO 2003). Focusing directly on a framework's purpose, the AF EAF supports:

- Alignment of requirements for information systems with the processes that support the AF missions
- Adequate AF, Joint, and combined interoperability
- Integration, assurance and security of information systems
- Prioritized allocation of resources to critical capabilities

- The application and maintenance of a set of standards by which the AF evaluates and acquires new systems (AF CIO 2003)

Throughout the referenced guidance, the designation of "governance" was commonly used to refer to the oversight of EA use as well as to describe its apparent benefits. However, absent from this depiction of "governance" is an EA endorsing environment consisting of allocated resources, management importance, or the need for culture change. Best practices describe governance structures to consist of IT investment management processes, communication strategies, ownership, and accountability. To progress past the current ineffectiveness of EA within the Federal Government, the GAO recommends:

> *The key to having a mature architecture program, and thereby realizing the benefits of an architecture-centric approach to IT investment decision making, is sustained executive leadership. This is because virtually all of the barriers to effectively developing and using architectures, such as parochialism, cultural resistance, adequate resources, and top management understanding, can be addressed through such leadership (US GAO 2008).*

An attitude focused towards allowing EA to work for an organization is consistent with the *governance* best practice. This factor appears to be most lacking amongst the AF policy and guidance. An EA attitude supporting the AF policy and guidance needs to be fueled with commander's intent in order to facilitate the alignment of IT with mission, not with just words of guidance, but with action.

Chapter IV described a case study representing the depiction of a typical, large-scale deployment of an enterprise software application. The portrayal of alignment represented by this real-world scenario complements the descriptive trend of this research by presenting the applicable nature of these best practices, creating a self-actualization of

alignment's inherent benefits. Providing additional insight, the case study allowed for several important realizations regarding the applicability of the EA best practices.

Concerning the application of the best practice *vision*, the case study showed that perhaps a committed EA vision does not have to be structured around a formal product. While the vision is important for driving the implementation of IT in an organization, its existence can be interpreted as a result of other initiatives. In the case of USAFE, their strategic plan served as the basis for their EA vision. Their ability to project power is structured around access, which calls for the enablement of mission accomplishment as well as the interoperability of capabilities. These concepts were applied throughout the implementation of the TMT project, and while not formally identified, they served as the vision behind its planning execution.

Another realization provided by the USAFE case study is the importance of thoroughly identifying the IT and processes of an organization. The TMT project went through great lengths to ensure the current task management process was identified. Utilizing an AFSO-21 process, the project management team was able to scrutinize the efficiency of the current process as well as capture its key players, capabilities and deficiencies of the current supporting IT and use that information towards establishing the goals for the solution to increase visibility and efficiency. The application of the *identification* best practice within USAFE possibly illustrates the value that comes from AF initiatives such as AFSO-21. It unquestionably portrayed how capturing one's IT and processes can assist with achieving alignment.

The value of applying the *framework* best practice comes with the consistent depiction of relationships and information within an organization. The USAFE task

management team was able to capture these entities without the use of a formally defined framework such as DoDAF or the AF EAF. The USAFE team used experience, insight, and common sense to depict the necessary components to create a successful project implementation. However, the created diagrams do not provide the consistency needed to depict integration with other programs or enterprises. A similar effort, creating its own diagrams, will not coincide with the diagrams used by the TMT project. A defined framework facilitates how to capture the Who, What, When, Where, Why, and How surrounding a process. Since a specified framework provides a consistent method to capture separate processes and projects, a variety of diagrams can be mapped together to illustrate the processes and systems comprising an entire enterprise.

As can be seen by the USAFE task management solution, the support of leadership contributes to the success or failure of a project. The USAFE environment understood the case for fixing the inefficient task management process and the project management team was allotted the necessary organizational freedom and resources to fix the problem. A retrospective look at the TMT project demonstrates how their environment, consisting of factors from the *governance* best practice, contributed to the project's success. This real-world depiction of "sustained executive leadership" is a representation of the necessity for leadership to convey a similar type of sustainment towards EA use to create an environment where EA benefits the Air Force (USGAO 2008).

Recommendations

As stated in the EA guidance analysis of Chapter III, the policy and guidance surrounding EA use is abundant. Lacking from this policy and guidance is the allocation of resources, management importance, or the need for culture change. Perhaps contributing to this dilemma is that it takes a substantial viewpoint of alignment to realize its benefit and that EA in and of itself has no intrinsic value. Conceivably, transposing the benefit of EA use towards its positive effects on other processes, such as IT portfolio management, modifies the focus of measurement to another entity, possibly allowing for a realization of its value. Case studies have shown alignment attributing to enhancements for the private sector, however, these enhancements contain factors such as growth, competitive enhancements, and affecting the bottom line, which are not a primary concern of the public sector.

The Decision Analysis approach of value-focused thinking (VFT) could be used to assist with quantifying value for DoD EA use. VFT elicits the desired objectives from a decision maker to apply critical thinking towards one's values or what are believed to be important factors in a decision. This process helps the decision maker determine their values concerning a decision, develop objectives based on these values, and structure them to determine the trade-offs between competing or conflicting objectives. VFT could be used to capture an "importance" weight of the four best practices as applied to an IT project. Associating value to the four best practices, the decision maker could further actualize alignment's inherent benefits and additionally promote an appreciation for EA efforts.

Some of the guidance described and analyzed within Chapter III, such as DoDAF, AFPD 33-4, and AFI 33-401, are in the process of being updated. Future research efforts could assess the achievement of alignment within the new concepts represented amongst these updates. Additional case studies could also be developed to analyze IT projects and EA efforts on their ability to capture alignment. These case studies could possibly be used towards associating the need for an EA program in order to achieve alignment. The best practices identified by this research are associated with alignment; they can be used to guide future implementations of IT projects and EA efforts, as well as retrospectively assess mission accomplishment.

Appendix A: Definition of Terms

Acronyms

AF	Air Force
AF EAF	Air Force Enterprise Architecture Framework
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AFSO-21	Air Force Smart Operations
AO	Action Officers
CCA	Clinger-Cohen Act of 1996
CIO	Chief Information Officer
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
CRM	Customer Relations Management
DAF	Department of the Air Force
DARS	DoD Architecture Registry System
DoD	Department of Defense
DoDAF	DoD Architecture Framework
DoDD	Department of Defense Directive
DS	Director of Staff
EA	Enterprise Architecture
E-Gov	E-Government
EIM	Enterprise Information Management
FEA	Federal Enterprise Architecture
FEAF	Federal Enterprise Architecture Framework
GIG	Global Information Grid
HQ	Headquarters
IT	Information Technology
MAJCOM	Major Command
NCOIC	Non-Commissioned Officer in Charge
NSS	National Security Systems
OCR	Office of Collateral Responsibility
OMB	Office of Management and Budget
OPR	Office of Primary Responsibility
RFI	Request for Information
SME	Subject matter experts
TBM	Theater Battle Management
TMT	Task Management Tool
USAFE	United States Air Forces of Europe
VFT	Value Focused Thinking

Bibliography

AF CIO. (2003). *Air Force Enterprise Architecture Framework*. Washington: HQ USAF.

Anaay, V. and A. Ortiz (2005). "How enterprise architectures can support integration," *Proceedings of the first international workshop on Interoperability of heterogeneous information systems* (pp. 25-30). Bremen: ACM.

Armour, F., S. Kaisler, and S. Liu (1999a). "A Big-Picture Look at Enterprise Architectures," *IT Professional*, 35-42 (January | February).

Armour, F., S. Kaisler, and S. Liu (1999b). "Building an Enterprise Architecture Step by Step," *IT Professional*, 31-39 (July | August).

Belue, J. (Jan 20, 2009). USAFE Knowledge Operations, Ramstein GE. Personal Correspondence.

Belue, J. (Dec 16, 2008). USAFE Knowledge Operations, Ramstein GE. Telephone Interview.

Chairman of the Joint Chiefs of Staff. (CJCS) (2008). *Interoperability and Supportability of Information Technology and National Security Systems.* CJCS Instruction 6212.01E. Washington: GPO.

CIO Council. (2001). *A Practical Guide to Federal Enterprise Architecture.*

CIO Council. (2000). *Architecture Alignment and Assessment Guide.*

CIO Council. (1999). *Federal Enterprise Architecture Framework Version 1.1.*

Conway, S. (2006). *AF Productivity Impact Study.* Task Management and RFI POM Report, Microsoft Services.

Department of the Air Force (DAF). (2006). *Enterprise Architecting.* AF Policy Directive (AFPD) 33-4. (2006). Washington: AF Office of Warfighting Integration and Chief Information Officer.

DAF. (2007). *Implementing Air Force Architectures.* Air Force Instruction (AFI) 33-401. Washington: AF Office of Warfighting Integration and Chief Information Officer.

Department of Defense (DoD) (2007). *DoD Architecture Framework (DoDAF) Volume 1: Definitions and Guidelines.*Washington: DoD.

DoD. (2002a) *Global Information Grid (GIG) Overarching Policy.* DoDD 8100.1. Washington: DoD.

DoD. (2004). *Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS).* DoD Directive (DoDD) 4630.5. Washington: DoD

DoD. (2002b). *Management of DoD Information Resources and Information Technology*. DoDD 8000.01. Washington: DoD.

Institute of Electrical and Electronics Engineers (IEEE). (2000). *IEEE Recommended Practice for Architectural Description of Software-Intensive Systems*. New York NY.

Kreizman, G., and B. Robertson (2006). *Integrating Security Into the Enterprise Architecture Framework.* Stamford CT: Gartner Inc. (G00137069).

Lagenberg, K., and A. Wegmann (2004). *Enterprise Architecture: What Aspects is Current Research Targeting?* Lausanne Switzerland: Laboratory of Systemic Modeling (IC/2004/77).

Luftman, J., R. Papp and T. Brier (1999). "Enablers and Inhibitors of Business-IT Alignment," *Communications of the Association for Information Systems*, 1.

Luftman, J. (2004). "Key Issues for IT Executives 2004," *MIS Quarterly Executive*, 4: 269-285.

Luftman, J., and R. Kempaiah (2007). "Key Issues for IT Executives 2007," *MIS Quarterly Executive,* 7: 99-112.

Maier, M., and E. Rechtin (2002). *The Art of Systems Architecting.* Boca Raton: CRC Press LLC.

Office of Management and Budget. (2007). *FEA Consolidated Reference Model Document.* (Conway 2006)

OMB (2007). *FEA Practice Guide*.

OMB. (2000). *Management of Federal Information Resources.* Circular No. A-130.

OMB. (2008). *Preparation, Submission, and Execution of the Budget*. Circular No. A-11.

Plazaola, L., J. Flores, E. Silva, N. Vargas and M. Ekstedt (2007). "An Approach to Associate Strategic Business-IT Alignment Assessment to Enterprise Architecture," *Conference on Systems Engineering Research.* Stevens Institute of Technology Campus, USA.

Rehkopf, T., and N. Wybolt (2003). "Top 10 Architecture Land Mines," *IT Professional*, 36-43 (November | December).

Robi, D. (2004). "Enterprise DoD Architecture Framework and the Motivational View," *CrossTalk The Journal of Defense Software Engineering*, 28-30 (April).

Ross, J., P. Weill and D. Robertson (2006). *Enterprise Architecture as Strategy*. Boston: Harvard Business School Press.

Ross, J. (2003). *Creating a Strategic IT Architecture Competency: Learning in Stages*. Cambridge MA: Center for Information Systems Research (4314-03).

Siegers, R. (2004). "The ABCs of AFs: Understanding Architecture Frameworks," *Proceedings of the INCOSE International Symposium.* Rochester, NY.

United States (US) Congress. (1996). *Information Technology Management Reform Act (Clinger-Cohen Act).* Public Law No. 104, 106th Congress. Washington: GPO.

US General Accounting Office (GAO). (2002). *Information Technology: Enterprise Architecture Use across the Federal Government Can Be Improved.* GAO-02-6.

US GAO. (2008). *DoD Business Systems Modernization: Military Departments Need to Strengthen Management of Enterprise Architecture Programs.* GAO-08-519.

Urbaczewski, L., and S. Mrdalj (2006). "A Comparison of Enterprise Architecture Frameworks," *Issues in Information Systems,*7:18-23.

Zachman, J. (1999). "A framework for information systems architecture," *IBM Systems Journal*, 38:454-470.

Zachman, J. (1997). "Enterprise Architecture: The issue of the century," *Database Programming and Design*, 44-53.

Vita

Master Sergeant (MSgt) Michael A. Fetters graduated from Ogemaw Heights High School in West Branch, Michigan. He enlisted in the Air Force in 1994 as a Communications-Computer Operations technician. MSgt Fetters' first assignment was at Elmendorf AFB, Alaska where he spent the next seven years working in a diverse collection of communications related roles consisting of Data Processing Center technician, Base Communications Center Operations Shift Supervisor, Theater Battle Management (TBM) Network Administrator, and Non-Commissioned Officer in Charge (NCOIC) of Unit Level TBM Systems. In 2001, MSgt Fetters was reassigned to the USAF Academy, Colorado, where he supported the AF Academy network as the Lead Network Messaging Technician. While in Colorado, MSgt Fetters completed his undergraduate studies earning him an Associate's Degree in Information Systems Management from the Community College of the Air Force and a BS in Computer Information Systems Management from Colorado Christian University. In 2004, MSgt Fetters was reassigned to Scott AFB, Illinois, were he served as NCOIC of Directory Services supporting Air Mobility Command's 65,000 users and 45,000 workstations. In 2007, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology, to pursue a MS degree in Information Resource Management. Upon graduating, he will be assigned to the HQ USAFE CIO Support Branch at Ramstein AB, Germany

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From – To)*
March 2009	Master's Thesis	September 2007 - March 2009

4. TITLE AND SUBTITLE

Achieving Alignment: An Analysis of Enterprise Architecture Best Practices within the United States Air Force

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Fetters, Michael A.,
Master Sergeant, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Way, Building 640
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GIR/ENV/09-M01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Intentionally left blank.

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This research uncovers areas of best practices that support achieving alignment between an organization's Information Technology (IT) and its business processes. One principal finding of this effort revealed that the means used to achieve alignment exists within the effective application of Enterprise Architecture (EA), a common practice found throughout the Federal Government, Department of Defense, and the Air Force. EA is the tool used to achieve alignment; likewise, the reason for developing architecture is to achieve alignment of IT investments and mission objectives. This research groups the best practices into *vision*, *identification*, *framework*, and *governance*. Interestingly, these practices relate to an Enterprise Architecture's depiction of the "to be" target state, the "as is" baseline, the tools and models used for communication, and the motivation and management of the "transition" plan. The insights achieved by this research should strengthen the use of Enterprise Architecture within the Air Force by enabling senior leaders and decision makers to align strategy and IT investment towards improving mission accomplishment.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
REPORT	**ABSTRACT**	**c. THIS PAGE**			John M. Colombi, PhD, AFIT/ENV
U	U	U	UU	76	**19b. TELEPHONE NUMBER** *(Include area code)* (937) 255-3636, ext 3347